

## Hand Related Injury Accident Trend in Metal Fabrication Industry

*Zamree Amin<sup>\*</sup>, Roslina Mohammad and Sa'ardin Abdul Aziz*

*UTM Razak School of Engineering and Advanced Technology,  
Universiti Teknologi Malaysia, 54100, Kuala Lumpur*

E-mail: zamree2@live.utm.my

### ***Abstract***

*The aim of this paper is to obtain the trend of accident related to hand injury in the Production Department of Metal Fabrication Process company located in south peninsular Malaysia. Accident data being obtained from year 2008 until 2012 showed an increment numbers of accident involving hand. In year 2008 the rate is 36.3%, year 2009 is 30%, year 2010 is 37.5%, year 2011 is 33.3% and year 2012 is 37.5%. Site survey has been conducted to assess the hazards contributed to hand injury from the metal fabrication activities being carried out. The hazards to be assessed were categorized into two factors which is Safety Factor and Ergonomic Risk Factor. The overall data results are discussed and compiled to obtain the hand related injury accident trend in metal fabrication process.*

**Keywords:** *Hand Injury; Metal Fabrication Industry; Safety Factor, Ergonomic Risk Factor, Metal Process*

### **1.0 INTRODUCTION**

Hand and wrist injury was defined as any injury occurring distal to proximal wrist crease as well as soft tissues injury to the forearm and fractures of the carpal bones, distal radius and ulna (Hill et. al, 1998). Historically, accident involving hand has been occurred since more than 30 years ago and it had caused a lot of losses either to organization or the person at work. In any workplace that required machineries as their daily operation, potential to expose in hand injury accident is high. The impact from the injury might lead to several types of disablement which end up changing to other occupation or early retirement. In textile industries there were severe records where most of the workers were suffering from disablement (B.B. Joshi, 1971). This phenomenon does not stop here, even after 10 years later when there were several improvements in terms of safety system such as machine guarding being implemented, hand accident rate is still increasing. In most workplace such manufacturing, hand injury involving machinery still occur due to workers tend to find short cut or ways to accidentally trap their hand during maintenance or cleaning works (S. M. Myles and A. H. N. Roberts, 1985). Furthermore, a stringent supervision in the usage of protective equipment and close monitoring on the procurement of equipments which not comply to safety rules and regulations, could prevent hand injury accident (Asli DavasAksan et. al, 2012). Some study also revealed that, injuries are fifth common death among men and sixth most common death among women where injuries involving hand are among the most frequent injuries (Pramod Devkota and Shiraz Ahmad, 2013). In terms of improvement plan, due to significant social, psychological and economic consequences, as well as permanent impairment, one of the most important areas of study is hand prevention study (Angela J. Koestler, 2010).

### **1.1 Background of Hand Injury**

The records from UK Department of Trade and Industry and from Leisure Accident Data Base in 2002 showed that from 16,003 accident reported, 60% is hand injury and 21% is due to hand tools (S. T. B. Williams and D. Power, 2011). Furthermore, hand tools also could cause vibration to hand and arm, known as Hand-Arm Vibration Syndrome (Heaver et. al, 2011). In small medium industry, a study has been carried out to identify the type and causes of hand related accident such as in food

manufacturing industries (Zaliha et. al, 2008). Hand injuries in oil industries also showed a serious sign such as at offshore platform. Hence, statistics of hand injuries in oil industries has been collected and analysed to identify the main contribution towards hand injuries (Pramod Devkota and Shiraz Ahmad, 2013). Besides industry, agriculture also plays an important role in the economic development of the country. A study in agriculture has been carried out to investigate the incident related to hand during farming and the result showed that laceration is the most type of injuries followed by fracture (T. B. Hansen and O. Carstensen, 1999). Apart from that, in agriculture the type of tools and machinery used for farming also cause different type of injury pattern (Mark Aaron Yaffe and F. Thomas Kaplan, 2014). In tourism industry, like boating and water sports, bites and stings from marine life are identified as factors for hand injury (Schwartz et. al, 2014). A study has also been conducted in textile industry to identify the type of hand injury and improvement shown through acute treatment method (S. M. Myles and A. H. N. Roberts, 1985). For injuries by high pressure injection, the hand injury severity is depends on several factors such as the degree of the initial wounding force and the properties of chemical being injected from the substance (Rossenwaser MP and Wei DH, 2014). Furthermore, high pressure water jet injuries can be categorized as small entry wounds with extensively underneath tissue damage (A. Mehra, 2006). In meat industry, laceration injury to the hand is the main type of injury identified and due to that incident, an improvement towards injury prevention has been studied (David C. Caple, 2000). Generally, hand injuries accident in manufacturing industry has been most contribute to an accidents where human factors is the main root cause of all accidents (Rosa Maria Reyes et. al, 2012).

## **1.2 Issues Related to Hand Accident**

Most industries in Malaysia are still lacking in mitigating the risk towards hand related injuries accident due to re-active action by employer. Five issues are observed as follow:

**1.2.1 Procedures.** The procedure on any jobs to be carried out is important and the absence or insufficient of such documents need to be overcome and improve especially to such critical activities that involve machineries with a sharp tools or rotating parts. Furthermore, using defective or poorly maintain machinery also might contribute to hand injury accidents at workplace (Leixnering et. al, 2013). In multi-national company or oil & gas industry, those issues are seriously observed where their management are committed in organizing awareness training and hand safety campaign such as in Halliburton (Rune Hobberstad and Jan Erik Erikson, 2008).

**1.2.2 Injury Rate.** Base on a study in Europe, hand injuries are a frequent occurrence and account for 41% of all occupational injuries (Leixnering et. al, 2013). In Malaysia, a number of accidents in overall industry sector shows decreasing, however manufacturing industry sector is still the main contribution from the total number of accidents. In 2012, manufacturing sector recorded 1720 accidents and shown an increasing trend compared to 2011 which was 1459 accidents. Referring to 2012 accident statistics, 1187 accidents were related to hand and finger. (Policy and Research Division, Department of Occupational Safety and Health, Malaysia).

**1.2.3 Cost of Accident.** The employer does not aware on the cost incurred when any accident happen in their organization. They always focus on the progress or result of the project. The direct and indirect cost of hand injury patient has been measured and the results showed that the indirect cost is higher than the direct cost (F. Sahin et. al, 2012). Besides that, in a study carried out revealed, hand injuries accident at workplace was identified as the most costly in terms of health care and production losses (Hans Eric-Rosberg et. al, 2013).

**1.2.4 Unreported Accident.** Unreported accident in some industries is become part of a trend nowadays in certain industry in Malaysia and in other developing countries. According to the study, developing countries is the most common in under-reporting their occupational accidents and only limited numbers of study investigating its risk factor (Asli DavasAksan et. al, 2012).

**1.2.5 Manufacturing Process Complexity.** Different type of manufacturing sector has its own process in producing the product. The employer should carry out specific risk assessment and control

measures to ensure the task is being executed safely. Recent study also revealed that, the employer was challenged to assess all machines and equipment, including guards and safety devices, which exposed to the highest risk of hand accident (Dean Glenn and David J. Sarkus, 2014).

## 2.0 METHODOLOGY

Site visit has been carried out at Production Department of the metal fabrication process company located in southern Malaysia. It then followed by site observation in the fabrication process to collect and gather information about all the processes being carried out. Once all the processes and activities being identified, the data will be analyze and the hazards contributing to hand injury according to safety hazard and ergonomic hazard will be determined. Accident data for five years (2008 to 2012) will be collected. The overall data collected will be studied and analyzed to obtain the trend of hand injury accident.

## 3.0 RESULTS AND DISCUSSION

Site observation has been conducted at the metal fabrication process company and the key processes of metal fabrication activities have been identified. Then the hazards of each critical process has been assessed and determined.

Table 2 described the eight key activities in metal fabrication process which categorized as prone to hand injury such as grinding, cutting, welding, gouging, polishing, high pressure cleaning, blasting and painting. The safety hazards being identified are entanglement, flying materials, dust, fumes, heat, radiation, electrocuted, noise, overshooting and paint fume. According to the list of hazards, direct hazards towards hand injury are entanglement, flying materials, electrocuted and overshooting whereas the indirect hazards towards hand injury are dust, fumes, heat, radiation and noise. According to the study, the etiological importance of acute hand injuries in occupation depends on factors such as safety training, working condition and usage of hand gloves (E. Kaya Bicer et. al, 2011).

Table 2: Metal Fabrication Activities and Hazards

Activity	Safety Hazards
Grinding	Entanglement, Flying materials, Dust
Cutting	Entanglement, Flying materials, Dust
Welding	Fumes, Heat, Radiation, Electrocution
Gouging	Fumes, Heat, Radiation, Electrocution, Noise
Polishing	Flying materials, Dust
High Pressure Cleaning	Flying materials, Overshooting
Blasting	Flying materials, Overshooting
Painting	Paint fume

Table 3 described eight types of tools and equipment being used in metal fabrication which contribute to Ergonomic Risk to workers. Tools being assessed are lathe machine, metal cutter, gas cutter, welding generator, gouging gun, power / hand tool and blasting gun. Ergonomic Risk Factor that being identified are Static Loading, Awkward Posture, Contact Stress, Heat, Dusty and Chemical Vapour. Ergonomic Risk Factor is identified as one of the contribution towards hand injury accident when the activities are carried out more than 2 hours continuously. Workers would felt stress, exhausted and loss concentration. Even though hand injuries were rarely lead to fatality, it would affect the overall quality of life which lead to absence from duty and unemployment (Jia Hu et. al, 2015).

Table 3: Tools and Machinery Vs. Ergonomic Risk Factor

Tools and Machinery	Ergonomic Risk Factor
Lathe Machine	Static loading, Awkward posture
Metal Cutter	Contact stress, Awkward posture
Gas Cutter	Contact stress, Awkward posture, Static loading, Heat
Welding Generator	Awkward posture, Static loading, Heat
Gouging Gun	Contact stress, Awkward posture, Static loading, Heat
Power tool/Hand tool	Contact stress, Awkward posture, Static loading
Blasting Gun	Awkward posture, Static loading, Dusty
Painting Gun	Awkward posture, Static loading, Chemical vapour

Accident data collected in the metal fabrication process company was based on the accident history for five years from 2008 until 2012. According to the accident history data, the total hand injury accidents will be compiled to obtain hand injury percentage.

Table 4 described the total number of accidents occurred in metal fabrication process for five years. From the data obtained, the hand injury rate can be defined and this is useful to analyse the trend of hand injury accident.

Table 4: Total Accident in Metal Fabrication Process

Year	Total Accident
2008	11
2009	10
2010	16
2011	18
2012	16

In 2008, the total accident cases were 11, in 2009 the total accident cases were 10, in 2010 the total accident cases were 16, in 2011 the total accident cases were 18 and in 2012 the total accident cases were 16. According to the number of accidents recorded, it showed an increasing accidents trend even though there is a slight decrease in 2012. Table 5 described hand injury rate in metal fabrication process from 2008 until 2012.

Table 5: Hand injury Accident vs. Total Accident

Total Accident (Year)	Hand Injury Accident (%)
11 (2008)	4 (36.3)
10 (2009)	3 (30.0)
16 (2010)	6 (37.5)
18 (2011)	6 (33.3)
16 (2012)	6 (37.5)

In 2008, from 11 accidents recorded, 4 accidents were hand injury accident and it contributed to 36.3% from annual accident statistics. In 2009, from 10 accidents recorded, 3 accidents were hand injury accident and it contributed to 30% from annual accident statistics. In 2010, from 16 accidents recorded, 6 accidents were hand injury accident and it contributed to 37.5% from annual accident statistics. In 2011, from 18 accidents recorded, 6 accidents were hand injury accident and it

contributed to 33.3% from annual accident statistics. In 2012, from 16 accidents recorded, 6 accidents were hand injury accident and it contributed to 37.5% from annual accident statistics.

From the statistics, it shows that the hand injury accident trend in metal fabrication process did not show any decreasing sign and the result, this study can be proposed for further improvement on hand injury accident in metal fabrication process.

#### 4.0 CONCLUSION

This study is to produce the information about the contribution factor towards hand injury in metal fabrication process. Each key process has been assessed in order to identify the hazards. It is then followed by assessing the tools and equipment used for fabrication activities to identify its ergonomic risk factors. The overall data of accidents occurred in metal fabrication process industry specifically to hand related injury accident has been collected. Finally the trend of hand related injury accident in metal fabrication process for 5 years is obtained. A strategic improvement plan is required as prevention towards hand related injury accident.

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